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ABSTRACT

Recommended for grades 7-9 science and/or social studies classes, this 8-10 day unit provides students with experiences in conserving energy through small conservation activities and practices. The unit consists of 11 activities with rationale, objectives, and instructional strategies provided for each activity. Students are given information on various energy conservation practices (adding insulation to homes; caulking and weatherstripping around doors, windows, and cracks; and proper upkeep of homes and appliances) as well as specific ways they can achieve greater conservation of limited resources. Students are also provided with opportunities to read electric and gas meters, to develop skills and ways to identify energy efficient appliances, and to bring information on some or all topics home for further investigation. The latter allows them to be energy conscious of their environmental surroundings as well as to transmit energy conservation information and practices to others. A list of process skills fostered in the unit, advanced teacher preparation, and evaluation suggestions are provided in the introduction. (Author/JN)

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ENERGY CONSERVATION IN THE HOME

Original Writers
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R. Doug Martin
Robert Starr
(Revised)

Recommended Subjects: Jr. High Social Studies and Jr. High Science

ACKNOWLEDGEMENTS

The original "Basic Teaching Units on Energy" consisted of a package of 30 instructional packets contained within three volumes. The original fourteen units were written at the University of Nebraska-Lincoln, under the auspices of the Nebraska Energy Office, by Nebraska teachers participating in a three-week Faculty Development Institute sponsored by the U.S. Department of Energy (summer, 1978). The units were edited by the following individuals:

—Dr. Donald McCurdy, Professor of Science Education, University of Nebraska-Lincoln;
—Mr. Gary A. Lay, Education Coordinator, Nebraska Energy Office; and
—Dr. Robert Reeder, Science Department Chairman, East High School, Lincoln, Nebraska.

An additional eight units were written by independent authors in the summer of 1979 and the final eight units were developed as a result of a second federal grant (summer, 1980).

The present format has been achieved as a result of an evaluation conducted by the Nebraska Energy Office, February, 1981. Rather than continue to offer all 30 units as a single package, the Nebraska Energy Office determined to revise, edit, and typeset the 10-12 highest quality units and continue to offer the other units in their present format.

The editors of these revised "Basic Teaching Units" wish to thank the individual writers, original editors, and clerical staff for their contributions in creating the original "Basic Teaching Units."

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TO THE INSTRUCTOR . . .

"Energy Conservation in the Home" contains activities which stress the importance of conservation principles. Students will examine everyday practices in which they can become energy conscious.

In addition to these classroom activities, students can take information home to be shared with the rest of their family. This not only reinforces what students learn, but allows them an opportunity to share conservation practices.

The innovative teacher may also transfer **classroom** activities to total **school** building activities. For instance, an energy audit of the school building could be performed. The main concept in this unit is to identify ways students can save energy everyday, both at home and at school.

Since material sources continue to change periodically, the source, **Energy Info—A Directory of Publications and Audio-Visual Materials From the Nebraska Energy Office,** contains a list of general topics available from the Nebraska Energy Office. You are encouraged to use the ordering page attached to this unit to order this booklet as well as other energy related materials.

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Abstract

One-fourth of all the energy used in the United States is consumed within our houses. Good conservation practices at home can extend those energy supplies as well as save consumers money. Students have a chance to conserve lots of energy through small conservation activities and practices.

Energy can be saved by adding insulation to homes, caulking and weatherstripping around doors, windows, and cracks, and by proper upkeep of homes and appliances. Throughout this unit, students are given information concerning these topics as well as specific ways they can achieve greater conservation of these limited resources.

Students will be given information enabling them to read electric and gas meters. The skills and ways to identify energy efficient appliances will also allow students to investigate more direct ways to save energy.

Each activity throughout the unit attempts to focus attention at the little (but very important) ways to conserve energy. Students may bring information on some or all topics home for further investigation. This allows them to be energy conscious of their environmental surroundings as well as to transmit this information to others.

Recommended Level

Grades 7-9

Academic Areas

Social Studies, Science

Time Required

8-10 days

Process Skills

—Calculating
—Collecting Information
—Comparing
—Computing
—Drawing
—Experimenting
—Identifying
—Locating
—Reading
—Writing

Advanced Teacher Preparation

Obtain: Energy films which may be applicable to a particular activity or unit. The following are available: from the Nebraska Energy Office:

1) **All About Insulation** (15 minutes) by Owens-Corning Fiberglas. Presents information about R-values, vapor barriers, and "how to" install batt insulation.
2) **Project Conserve-Saving Home Energy** (20 minutes) Provides information on furnace inspections and other home energy saving ideas.
3) **Saving Energy At Home** (13 minutes) Shows how home energy waste can be reduced. Topics discussed include window treatments, major appliances, lighting and food preparation.

Read: **Energy Info—A Directory of Publications and Audio-Visual Materials From the Nebraska Energy Office.**

Evaluation Suggestions

This unit allows teachers to develop their own instruments for evaluation. Many of the activities do have student worksheets which will give some indication of student success.

Instructor Information. . .

Energy Attitude Survey

Rationale: Students will gain an understanding of energy waste in the home. Students will determine how energy is being wasted and how they can conserve more energy than they presently do.

Objectives: Students will be able to complete an energy attitude survey.

Students will be able to compute percentages in compiling results.

Implementation: During the first part of this unit, give students the energy survey (Activity #1). Tabulate the results. **Note:** Make a transparency of the energy attitude survey pages.

Debriefing: Review the questions with students. Allow discussion to take place on selected areas of interest. You may want to focus more on those questions which could be answered in several ways.

Energy Conservation in the Home
Energy Attitude Survey
Activity #1

Transparency

Directions: As each question is read to you, vote "yes," "no," or "don't know." I will count the number for each and record it in the blank.

1. Do you believe people should set their thermostats at 68°F during the winter?

   Yes _____ No _____ Don't Know _____

2. Can you save energy by caulking and weatherstripping your house? Yes _____ No _____ Don't Know _____

3. Should draperies and shades be closed at night during the heating season?

   Yes _____ No _____ Don't Know _____

4. Should attics be insulated? Yes _____ No _____ Don't Know _____

5. Do interior walls need insulation? Yes _____ No _____ Don't Know _____

6. In saving energy, is fluorescent lighting cheaper than incandescent lamp lighting?

   Yes _____ No _____ Don't Know _____

7. Should water heaters be insulated on the outside? Yes _____ No _____ Don't Know _____

8. Should you bake more than one food item at a time when using an oven for cooking?

   Yes _____ No _____ Don't Know _____

9. Should you wash when there is only a half load of clothes? Yes _____ No _____ Don't Know _____

10. Can you save energy by locating the washer near the water heater? Yes _____ No _____ Don't Know _____

11. Would you be willing to reduce your standard of living to conserve energy?

    Yes _____ No _____ Don't Know _____

12. Do you believe you are an energy "conserver"? Yes _____ No _____ Don't Know _____

13. Do you feel technology will "bail us out" of the energy problem? Yes _____ No _____ Don't Know _____

14. Are you going to **do** something to save energy today? Yes _____ No _____ Don't Know _____

Directions: Now give students the "Energy Attitude Tally" sheet. Have them find the percentages for each response. For example: On question one, if 200 students responded; 100 say yes, 60 no, and 40 don't know, then the percent saying "yes" is 100/200 or 50%, saying "no" is 60/200 or 30%; saying "don't know" is 40/200 or 20%. Note that the total of the percent figures given should equal 100.

Energy Conservation in the Home
Energy Attitude Survey
Activity #1
Tally Sheet

Name _____

Date _____

Question	Yes	Percent	No	Percent	Don't Know	Percent
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						

Instructor Information. . .

FACT SHEET

1. Do you believe people should set their thermostats at 68°F during the winter?

   "Yes" Some elderly people or those under medical advisement may need to keep their thermostats at a certain setting above 68°F.

   "No" Usually this is a waste of unnecessary energy. If you lower the temperature, setting back 24 hours a day, you will save three percent of your fuel bill for each degree of setback.

2. Can you save energy by caulking and weatherstripping your house?

   "Yes" Caulking and weatherstripping are good ways to save energy. It's worth your while to check and see if you need caulking, putty, or weatherstripping on your windows and doors.

3. Should draperies and shades be closed at night and on cloudy days during the winter season?

   "Yes" Closing drapes on cloudy days reduces heat loss through windows. Drapes or venetian blinds can reduce window heat losses.

4. Should attics be insulated?

   "Yes" Attic insulation is one of the most important energy saving home improvements you can make.

5. Do interior walls need insulation?

   "Yes" Heat is lost from the home through the walls as heat flows by conduction through the building materials. A well-insulated building will also stay cooler in the summer.

6. In saving energy, is fluorescent lighting more efficient than incandescent lamp lighting?

   "Yes" A 25-watt fluorescent bulb gives off as much light as a 100-watt incandescent (bulb), but costs one fourth as much to use.

Instructor Information. . .

7. Should water heaters be insulated on the outside?

   "Yes" Just as a blanket or a coat helps maintain your body temperature, a storage tank protected by additional layers of insulation maintains water temperatures better and longer. **Extreme care must be exercised when installing the insulation around a gas heater.**

8. Should you bake more than one food item at a time when using an oven for cooking?

   "Yes" Whenever this is possible, it is a good idea. By doing this, you can turn the oven off sooner. This saves energy for another time.

9. Should you wash when there is only a half load of clothes?

   "No" Fill washers (unless they have small load attachments or variable water levels), but do not overload them. You can save considerable amounts of energy in the laundry area through conservation of hot water and full loads.

10. Can you save energy by locating the washer near the water heater?

    "Yes" Heating water accounts for about 20 percent of all the energy we use in our homes. The shorter the distance water has to travel through pipes, the more heat is retained and the less hot water has to be made.

11. Would you be willing to reduce your standard of living to conserve energy?

    "Yes" Some people may be willing to give up energy now so that others can use it later.

12. Do you believe you are an energy "conserver"?

    Ask students for their reasons.

13. Do you feel technology will "bail us out" of the energy problem?

    Ask students for their reasons.

14. Are you going to **do** something to save energy today?

    Ask students for their reasons.

Instructor Information. . .

How to Read Your Electric Meter

Rationale: If students can read their electric meter, they can keep track of the amount of energy they use in their homes. This will allow them to take effective measures to save energy.

Objectives: Students will be able to read their own home electric meters.

Students will be able to read several meters in activity #2.

Implementation: Have students explain how a meter works, how to read it.

Debriefing: Go over the problems to check whether most students know how to read their electric meter dials. They should then be able to complete the worksheets which have several problems.

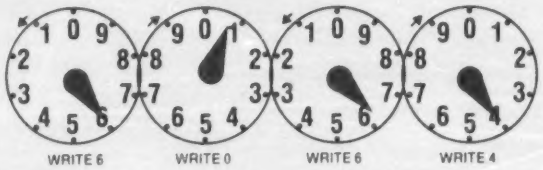
Name _____

Date _____

How to Read Your Electric Meter

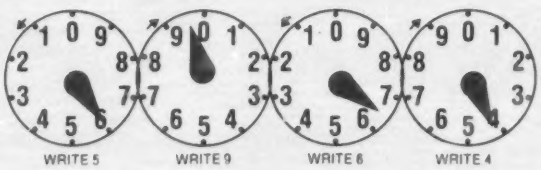
You will need to read your electric meter, record the readings and compare from week to week in order to know for sure if you are saving energy.

The four dials are like watch faces lined in a row (note that every other dial moves counterclockwise). In the first illustration, the reading is 6,064 kilowatt hours.



Notice that when the pointer has not quite reached a number, you should record the number previous—the number "0" (zero) instead of the number "1" (one) on the second dial, for example.

When the pointer on the particular dial you are recording seems to be directly on a number, look at the dial to its right; if the pointer on the right side of the dial has not yet passed "0", then write down the previous lower number on the dial you are recording. The principle (which makes sense if you think in terms of accumulating tens, hundreds, and thousands) is much easier illustrated than described. The correct reading for the meter below is: 5,964 kilowatt hours. Your meter may have five dials instead of four. If so, read the additional dial as well.



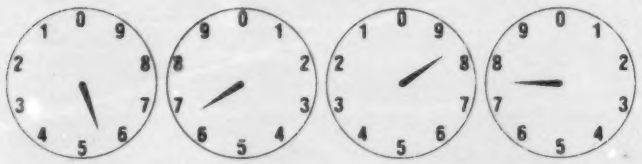
Name _____

Date _____

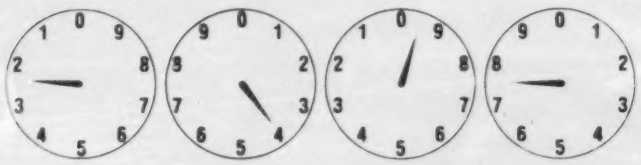
Directions: Read each set of dials below. Write the correct reading in the blank space.

1. ____ ____ ____ ____

2. ____ ____ ____ ____

3.  ____ ____ ____ ____

4. ____ ____ ____ ____

5.  ____ ____ ____ ____

6. ____ ____ ____ ____

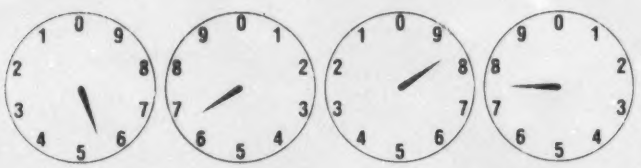
Energy Conservation in the Home
Activity #2
Answer Sheet

Instructor Information. . .

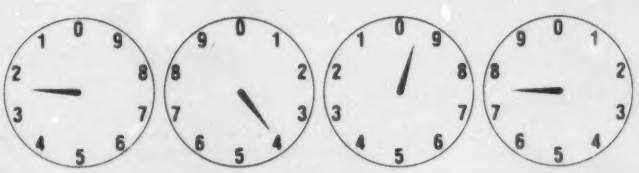
Directions: Read each set of dials below. Write the correct reading in the blank space.

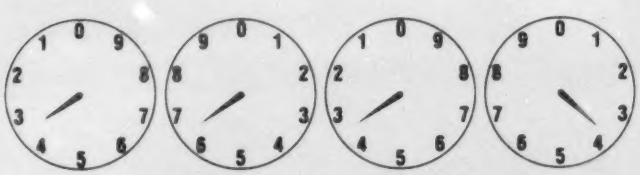
1. 9 0 4 0

2. 2 9 9 9

3.  5 6 8 7

4. 0 8 4 6

5.  2 3 9 7

6.  3 6 3 3

Instructor Information. . .

Reading A Gas Meter

Rationale:

If students become aware of the amount of gas they use in their home each month, they will be able to determine the amount of gas which can then be saved through simple conservation practices.

Objectives:

Students will be able to read the gas meters in their homes.

Students will be able to record daily or weekly gas usage information.

Students will be able to graph this information.

Implementation:

Hand out "Reading a Gas Meter" activity (2 pages). Read this information to students and explain how the dials function on the gas meter. Students should then be able to read the meter dials and record the correct readings on their sheets.

An additional activity is the "Southern California Gas Company" worksheet and "Reading A Gas Bill." This activity allows students who may have more advanced skill ability to actually read and interpret this example of a gas bill.

Finally, there are two pages entitled "Gas Diary: One Day" and "Gas Diary: One Week." These worksheets direct students to keep records for the amount of gas used over a period of time. You may choose one or both of these to use with your students depending on time and depth of study.

Debriefing:

Discuss the dial reading worksheet if there are questions. The other worksheets can be discussed individually or as a class depending upon how many of the students complete them.

Name _____

Date _____

Reading A Gas Meter

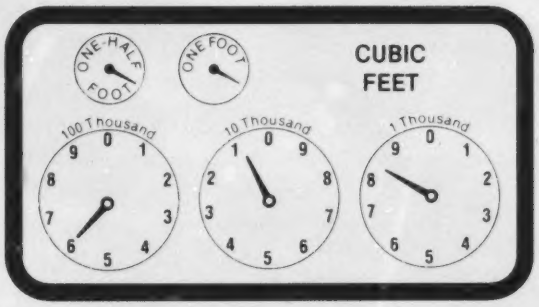
You will find it easy to learn how to read your gas meter, since you already know how to read an electric meter. The hands on the dials of the gas meter go around the same way as the hands on the electric meter, and follow the same rules:

If the hand is between two numbers, the reading is the lower of the two numbers.

The dials read from left to right, just like the numerals on a page.

If a hand seems to be exactly on a number, look at the dial to the right. If the hand on that dial is between 0 and 1, the reading is the number the hand is on. If the hand on the other dial is between 9 and 0, the reading is the next lower number.

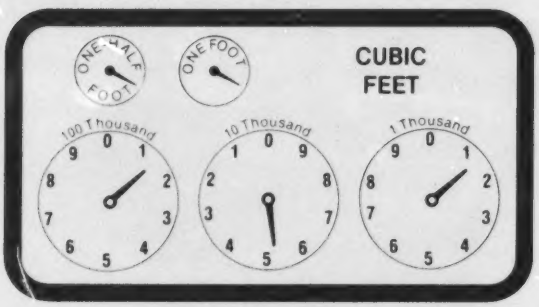
Most gas meters look something like this:



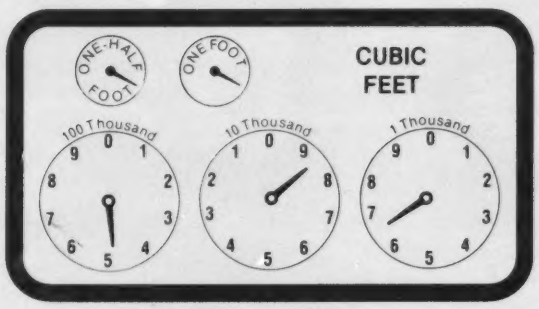
On the top are two dials all by themselves. They are marked "one-half cubic foot" and "one cubic foot." The gas company uses these dials to check the meters, to make sure they are accurate. They are not used when you read the meter.

Notice that the dial on the far right is marked "1 Thousand." This means that each time the pointer on this dial goes around, a thousand cubic feet of natural gas has been used. The "5" on this dial, therefore, means 500 cubic feet. Because there are no hundred's or ten's dials, we must add two zeros to our reading to get the correct number of cubic feet.

Here are some meters. Write down their readings in the blanks.



1. _____ _____ , _____ 00



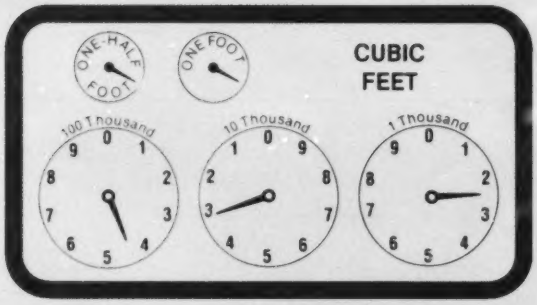
2. _____ _____ , _____ 00

Name _____

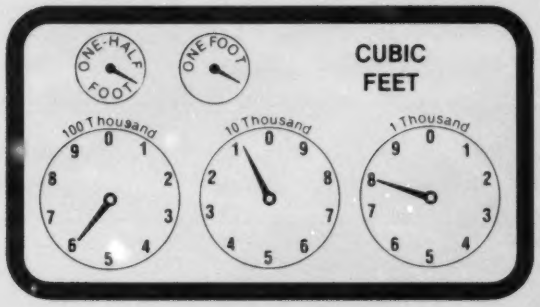
Date _____

Reading A Gas Meter

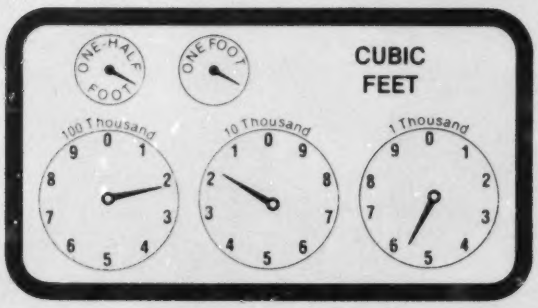
Directions: Here are more meters. Write down their readings in the blanks provided.



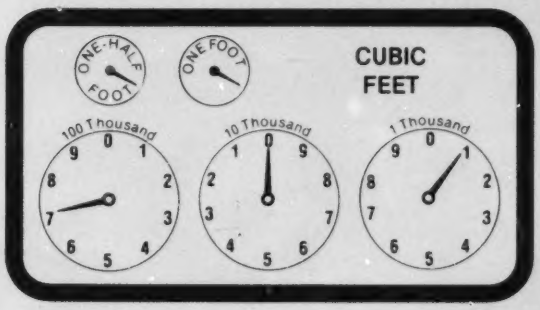
3. _____ _____ , _____ 00



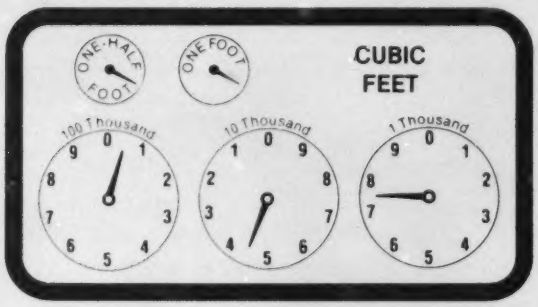
4. _____ _____ , _____ 00



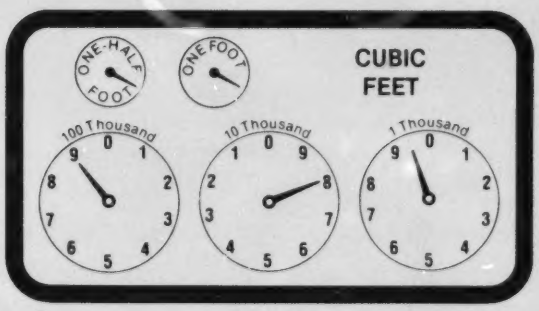
5. _____ _____ , _____ 00



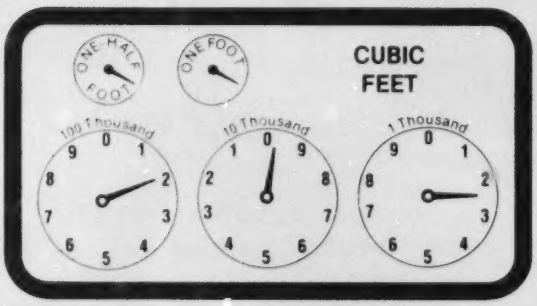
6. _____ _____ , _____ 00



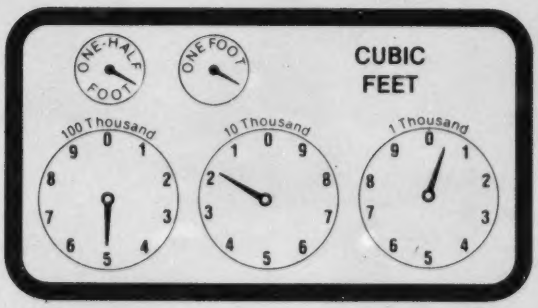
7. _____ _____ , _____ 00



8. _____ _____ , _____ 00



9. _____ _____ , _____ 00



10. _____ _____ , _____ 00

Instructor Information. . .

Reading A Gas Meter

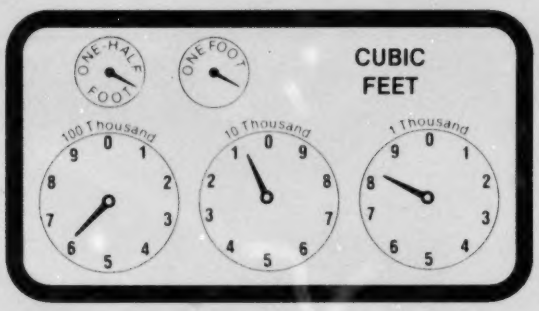
You will find it easy to learn how to read your gas meter, since you already know how to read an electric meter. The hands on the dials of the gas meter go around the same way as the hands on the electric meter, and follow the same rules:

If the hand is between two numbers, the reading is the lower of the two numbers.

The dials read from left to right, just like the numerals on a page.

If a hand seems to be exactly on a number, look at the dial to the right. If the hand on that dial is between 0 and 1, the reading is the number the hand is on. If the hand on the other dial is between 9 and 0, the reading is the next lower number.

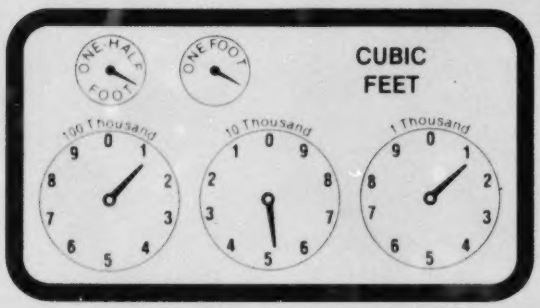
Most gas meters look something like this:



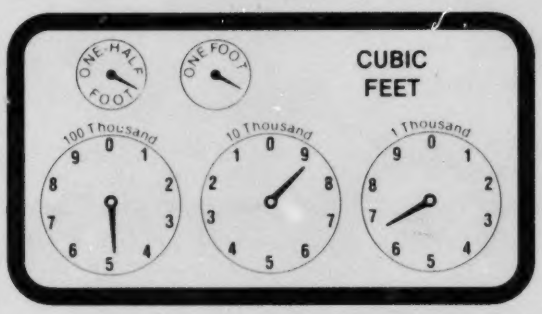
On the top are two dials all by themselves. They are marked "one-half cubic foot" and "one cubic foot." The gas company uses these dials to check the meters, to make sure they are accurate. They are not used when you read the meter.

Notice that the dial on the far right is marked "1 Thousand." This means that each time the pointer on this dial goes around, a thousand cubic feet of natural gas has been used. The "5" on this dial, therefore, means 500 cubic feet. Because there are no hundred's or ten's dials, we must add two zeros to our reading to get the correct number of cubic feet.

Here are some meters. Write down their readings in the blanks.



1. 1 5 , 1 00

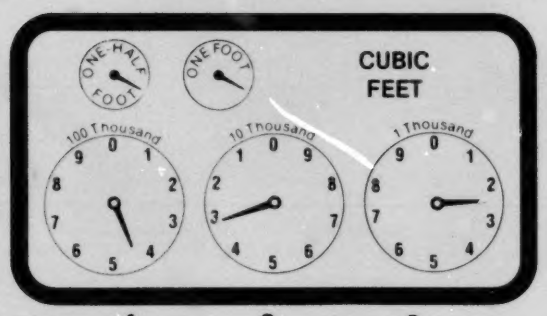


2. 4 8 , 6 00

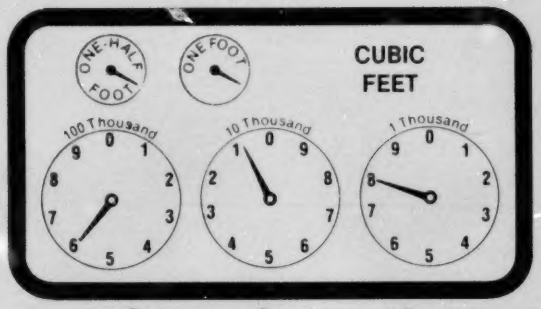
Instructor Information . . .

Reading A Gas Meter

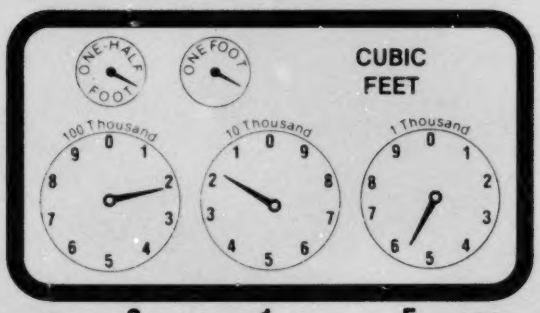
Directions: Here are more meters. Write down their readings in the blanks provided.



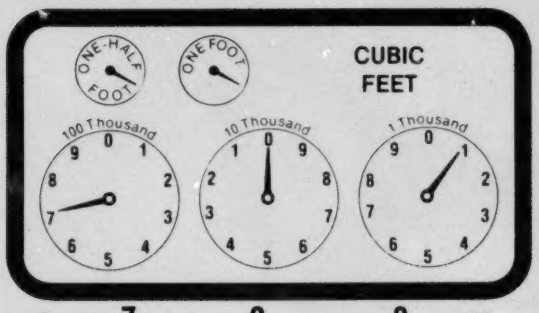
3. 4 3 , 2 00



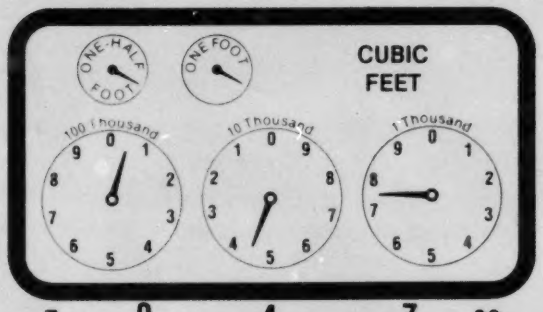
4. 6 0 , 8 00



5. 2 1 , 5 00

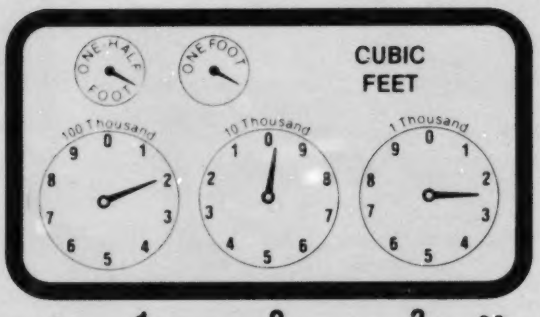


6. 7 0 , 0 00

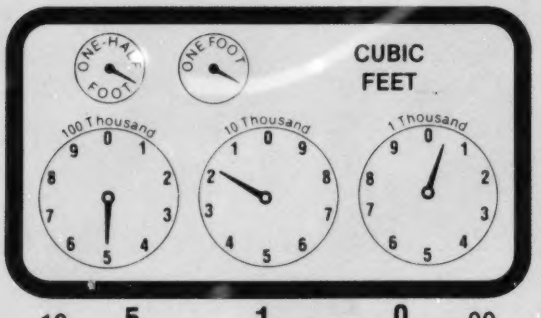


7. 0 4 , 7 00

8. 8 8 , 9 00



9. 1 9 , 2 00



10. 5 1 , 0 00

Energy Conservation in the Home
Activity #3
Worksheet, Page 1

Name _____

Date _____

A Gas Bill

From

Southern California Gas Company

PLEASE RETURN THIS PART WITH YOUR PAYMENT
TO SOUTHERN CALIFORNIA GAS COMPANY

SERVICE ADDRESS
110 1ST ST
SN MONICA CA 90400

JOHN FORD
110 1ST ST
SN MONICA CA 90400

DATE MAILED
AUG 05 1930

PLEASE PAY THIS AMOUNT $ 12.84

THIS BILL IS NOW DUE AND PAYABLE
DEDUCT RECENT PAYMENTS NOT CREDITED

02 2580 592 2095 00001284 60 02258059220950000128460

Please bring entire bill if payment is made in person. See other side for addresses of Company Offices

DETACH HERE

JOHN FORD
110 1ST ST
SN MONICA CA 90400

SOUTHERN CALIFORNIA GAS COMPANY
TELEPHONE (213) 672-5041

Your Account Number	Rate Schedule
02-2580-592-2095-6	R13

BILLING PERIOD FROM	TO	METER READINGS PREVIOUS	PRESENT	DIFFERENCE	BILLING FACTOR		THERMS
JUL 02 80	AUG 01 80	5094	5125	31	X 1.063	=	33

NEXT METER READING
DATE SEP 02

CUSTOMER CHARGE		$	3.10
LIFELINE THERMS	26 @ $.25740#=		6.69
USAGE OVER LIFELINE:	7 @ .34807#=		2.44
CITY TAX 5%			.61
TOTAL CURRENT CHARGES			12.84

AMOUNT

PRORATED DUE TO RATE CHANGE EFFECTIVE 07-06-80
DATE MAILED-AUG 05 1980 TOTAL AMOUNT DUE $ 12.84

SUMMER ENERGY SAVERS - USE FANS INSTEAD OF AIR CONDITIONERS - INSULATE ATTIC - VENTILATE ATTIC SPACE - PROVIDE OUTSIDE SHADE OVER SUNNY WINDOWS -

COMPARE YOUR AVERAGE DAILY USE WITH LAST YEAR

BILLING PERIOD	BILLING DAYS	THERMS BILLED	DAILY AVERAGE
THIS YEAR	30	33	1.1 THERMS
LAST YEAR	30	29	1.0 THERMS

Name _____

Date _____

Directions: Use the page labeled, "A Gas Bill From Southern California Gas Company" to answer the following:

1. Every customer of the gas company has a different account number (in a big city, there are often people with similar names). What is this customer's account number?

   _____.

2. What telephone number should they call if they have a question about their gas bill? _____
3. What was the date of the last meter reading? _____
4. What was the meter reading? _____
5. How many days have gone by between meter readings? _____ days
6. How many cubic feet of gas have been used during the time between meter readings? (Remember that the numbers on the bills are hundreds of cubic feet).

   _____ cubic feet

7. Find the number used to convert the volume of gas metered to its heating value. What is it for this address?
   _____
8. How many therms did the customer use? _____ therms
9. How many Btu's were obtainable from the gas this customer bought?
   (Remember 1 therm = 100,000 Btu) _____ Btu's
10. What did the customer pay for each of the first 26 therms? $_____
11. What did the customer pay for each therm after 26? $_____
12. How much were the taxes? $_____
13. How much is the customer's total bill? $_____
14. Did the customer use more or less energy this year than last year? _____
    What percent of the customer's average daily consumption last year was the consumption for this year?
    _____%

Energy Conservation in the Home
Reading A Gas Bill
Activity #3
Answer Sheet

Instructor Information. . .

Directions: Use the page labeled, "A Gas Bill From Southern California Gas Company" to answer the following:

1. Every customer of the gas company has a different account number (in a big city, there are often people with similar names). What is this customer's account number?

   02-2580-592-2095-6.

2. What telephone number should they call if they have a question about their gas bill? (213) 672-5041
3. What was the date of the last meter reading? June 2 to July 1, 1980
4. What was the meter reading? 5125
5. How many days have gone by between meter readings? 30 days
6. How many cubic feet of gas have been used during the time between meter readings? (Remember that the numbers on the bills are hundreds of cubic feet).

   33 cubic feet

7. Find the number used to convert the volume of gas metered to its heating value. What is it for this address? 1.063
8. How many therms did the customer use? 33 therms
9. How many Btu's were obtainable from the gas this customer bought? (Remember 1 therm = 100,000 Btu) 3,300,000 Btu's
10. What did the customer pay for each of the first 26 therms? $.25740 or $6.69
11. What did the customer pay for each therm after 26? $.34807 or $2.44
12. How much were the taxes? $.61
13. How much is the customer's total bill? $12.84
14. Did the customer use more or less energy this year than last year? more
    What percent of the customer's average daily consumption last year was the consumption for this year? 1.1 %

Energy Conservation in the Home
Activity #3
Worksheet

Name _____

Date _____

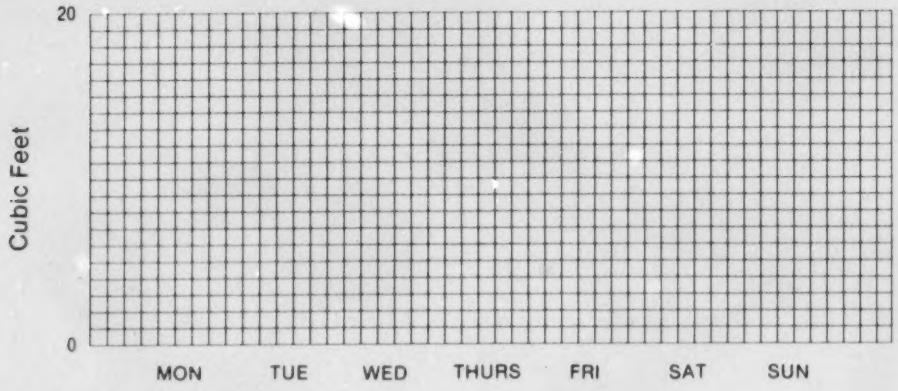
GAS DIARY: ONE WEEK

Directions: During one week, every day, at the same time of day, read the gas meter in your home. Of course, if you wanted to measure exactly by days, you would read the meter at midnight. But a good practical time to read it is before going to school or after dinner.

Date I began: _____

Day of Week	Time of Reading	Reading	Cubic Feet Used in 24 Hours
Sunday			
Monday			
Tuesday			
Wednesday			
Thursday			
Friday			
Saturday			

Use this form to make a bar graph of your weekly gas consumption.



Do you notice any bumps? What caused them?

_____

_____

Energy Conservation in the Home
Activity #3
Worksheet

Name _____

Date _____

GAS DIARY: ONE DAY

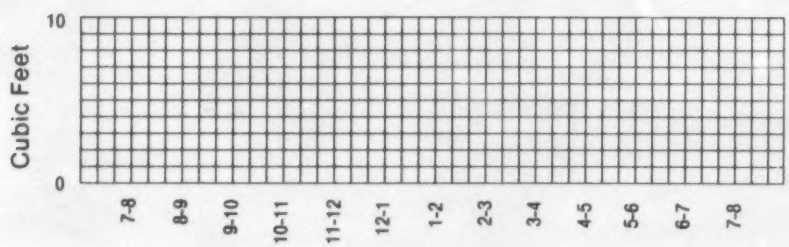
Directions: Choose one day and read your gas meter every hour on the hour. Record your readings below.

Day of the Week: _____

	Readings
7 AM	
8 AM	
9 AM	
10 AM	
11 AM	
Noon	
1 PM	
2 PM	
3 PM	
4 PM	
5 PM	
6 PM	
7 PM	
8 PM	

	Consumption
7-8	
8-9	
9-10	
10-11	
11-12	
Noon-1	
1-2	
2-3	
3-4	
4-5	
5-6	
6-7	
7-8	

Use this form to make a bar graph of your weekly gas consumption.



Save this sheet. On a different day of the week, or in a different season, do the activity again and see if your pattern of consumption has changed.

Instructor Information. . .

Determining BTU's

Rationale: The following experiment is designed so that students will acquire an understanding of the terms used to identify electrical energy and heat energy and how they are related to each other. By understanding these terms students will be better informed about the energy area.

Objective: Students will be able to determine the number of BTU's produced per kilowatt-hour of electricity.

Implementation: Gather necessary materials for the experiment (They are mentioned on the following page). Follow the procedures, examine the calculations, and solve the problems given. **Note to the Instructor:** An AC voltmeter (0-150 volts) and an AC ammeter (0-5 amp) would be useful but not necessary for this experiment. If they are not available use the watt rating of the heater involved.

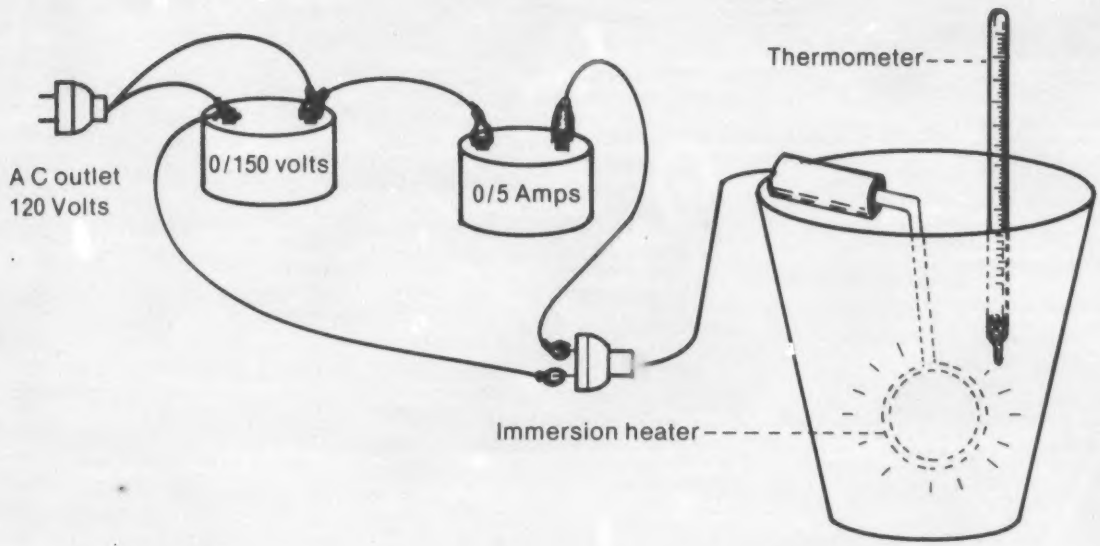
Debriefing: It may be necessary to demonstrate how some of these problems could be solved.

Energy Conservation in the Home
Activity #4
Worksheet

Name _____

Date _____

Materials: 300 watt immersion heater (the kind used to make a cup of coffee), styrofoam cup, thermometer-°F, 250 ml graduated cylinder, AC voltmeter (0-150 volts) AC ammeter (0-5 amp), 4 wires with battery clips.



Procedure: Wire up apparatus as shown in the diagram above (if voltmeter and ammeter are unavailable, they may be omitted, then use the watt rating of the heater.

1. Fill styrofoam cup with 227 ml of water (1/2 lb.) and record the initial temperature of the water.
2. Plug the heater into AC outlet for exactly 2 minutes.* Record the volts, amps, and final temperature.

Initial Temp. of H_2O T_i	Final Temp. of H_2O T_f	Amps	Volts	Time

*NOTE: Time may vary but the water must not be allowed to boil.

Instructor Information. . .

Calculations:

No. of Btu's Acquired by H_2O = $(T_f - T_i)$ x .5 lb. of water

$$\text{No. of KWH Used} = \frac{\text{Amps x Volts x Hours}}{1000}$$

Example Results:

Volts	Amps	Initial Temp.	Final Temp.
125	2.8	60°F	136.5°F

Electrical Input = volts x amps = watts or KW

125 v x 2.8 a = 350w or .35KW

Since .35 kilowatts were used for 2 minutes or 1/30 hours, then .35 KW x 1/30 hrs. = .0116KWH

The heat energy produced = .5 lb. of water x (136.5 - 60) = .5 x 76.5 = 38.25

If it takes .0116 KWH to produce 38.25 Btu, then $\frac{.0116\text{KWH}}{.0116} = \frac{38.25\text{ Btu}}{.0116}$ or 1 KWH = 3293 Btu.

This value compares favorably to the accepted value of 3412 Btu per KWH.

Name _____

Date _____

Energy Relationships

Equations to be used in solution of problems are as follows:

watts = amps x volts **Btu** = lbs. of water x temp. change °F

kilowatt = 1000 watts **kilowatt-hour** = kilowatts x hours

NOTE: The answers are shown at the bottom of the second page.

1. What is measured in amps? _____
2. The voltage of an ordinary electrical outlet is _____ volts.
3. How many Btu's are required to raise the temperature of 3 pounds of water 24 degrees F? _____
4. How many watts of electrical energy are being used when an electrical current of 8 amps is flowing at a voltage of 120 volts? _____
5. An electric iron rated at 1000 watts plugged into 120 volts uses how many amps of current? _____
6. How many Btu's are required to heat 1 gallon of water from 60° to 140°F? (Note: 1 gallon weighs 8 lbs.) _____
7. If it takes 6 gallons of hot water to take a bath, how many Btu's are required (See problem 6). _____
8. If the water in question 7 is heated by electricity at a rate of 4¢ for each kilowatt-hour, what does it cost to heat the water (3412 Btu in a KWH) _____
9. A teakettle with 3/4 of a gallon of water heated on an electric stove from 60° to 210°F needs how many Btu's of heat? _____
10. How many KWH of electricity are required to heat 12 teakettles full? _____
11. At 4¢ for each KWH, what is the cost of heating 12 teakettles of water? _____
12. When natural gas is burned, 900 Btu's of heat are produced for each cubic foot of gas. How many cubic feet of gas would be needed to heat 1 teakettle of water? _____

Name _____

Date _____

13. How many cubic feet of gas are needed for 12 teakettles of water? _____

14. Gas costs 25¢ for 100 cubic feet. What is the cost to heat the 12 teakettles of water? _____

15. Is it less expensive to use gas or electricity to heat water? Explain.

_____

_____

_____

Answers:

1. Electrical current
2. 120
3. 72
4. 960
5. 8.33
6. 640
7. 3840
8. 4.5¢
9. 900
10. 3.16
11. 12.64¢
12. 1
13. 12
14. 3
15. Depends, answers will vary.

Instructor Information. . .

Glossary Work

Rationale: Energy terminology aids in explaining some of the energy concepts we deal with everyday. Students need exposure to vocabulary repeatedly before they will be able to grasp word meanings.

Objective: Students will be able to use their glossary in identifying specific terms to match the definitions.

Implementation: Give each student a copy of the "Glossary" to begin studying vocabulary words. Hand out the "Glossary Activity" and have them complete it. The answers are on the following page of the activity. As you proceed through the unit, you may administer "Energy Terms" when students have become familiar with the vocabulary.

Debriefing: Continue to review vocabulary daily with students. "Identifying Energy Terms" can be given at different times during the unit or at the end of the unit.

Name _____

Date _____

GLOSSARY

Amp. Measure of the rate of energy flow through a conductor.

British Thermal Unit (BTU). The quantity of heat required to raise the temperature of one pound of water one degree farenheit at or near, its point of maximum density (39.1°F).

Calorie. The amount of heat necessary to raise one gram of water at 15°C, 1°C. The National Bureau of Standards defines the calorie as 4.18400 joules. (1 BTU is equivalent to 1055 joules.)

Celsius Scale. The temperature scale using the freezing point as 0 and the boiling point as 100, with 100 equal divisions or degrees between; also known as the Centigrade Scale.

Current (Electric). The rate of transfer of electricity.

Electrical Energy. The energy associated with electric charges and their movements. Measured in watt hours and kilowatt hours. One watt-hour equals 860 calories.

Energy. The capability of doing work. Potential energy is energy due to the position of one body with respect to another or relative parts of the same body. Kinetic energy is due to motion.

Heat. Energy possessed by a substance in the form of kinetic energy, usually measured in calories or, in space heating, by the British thermal unit. Heat is transmitted by conduction, convection, or radiation.

Heat Transfer.

1. **Conduction.** Heat moves from hot solid material to cold solid material.
2. **Convection.** Heat moving through air currents.
3. **Radiation.** Heat energy moving through space such as from the sun to the earth.

Infiltration. Heat movement from an area of high concentration to an area of low concentration.

Insulation. A substance that insulates is one that can slow down the flow of heat or sound.

Kilowatt (KW). The unit of power equal to 1,000 watts, 3.413 Btu's or 1,341 horsepower. Roughly a power of one kw is capable of raising the temperature of a pound (pint) of water 1°F in one second.

Kilowatt-Hour (KWH). The amount of work or energy delivered during the steady consumption of one kilowatt of power for a period of one hour; equivalent to 3.412 Btu's.

Natural Gas. Naturally-occurring mixtures of hydrocarbon gases, mostly methane, and vapors occurring naturally in certain geologic formation; usually found associated with oil.

R-Value. Thermal resistance; computed by the conductivity divided into one. The measure of resistance to heat flow.

Voltage. The amount of force employed to move a quantity of electricity; measured in volts.

Name _____

Date _____

GLOSSARY WORKSHEET

Directions: Choose the correct word for each sentence and write it in the blank. Use your **Glossary** if you are unsure of any meanings.

1. The rate of transfer of electricity is known as _____. (current, calorie)
2. The capability of doing work is known as _____. (energy, insulation)
3. A substance that slows down the flow of heat or sound is _____. (insulation, infiltration)
4. _____ is the measure of resistance to heat flow; thermal resistance. (R-value, voltage)
5. The amount of heat necessary to raise one gram of water at 15°C, 1°C is known as a _____. (calorie, ton)
6. The unit of power equal to 1,000 watts is a _____ (calorie, kilowatt).
7. An _____ is a measure of the rate of energy flow through a conductor (ounce, Amp.).
8. Naturally-occurring mixtures of hydrocarbon gases, mostly methane, and vapors occurring naturally in certain geological formation is _____ _____. (air pressure, natural gas)
9. The _____ _____ is the temperature scale using the freezing point as 0 and the boiling point as 100. (Kilowatt-hour, celsius scale)
10. Heat movement from an area of high concentration to an area of low concentration is _____. (infiltration, insulation).

Name _____

Date _____

Identifying Energy Terms

Directions: Circle the answer which best completes each sentence.

1. Energy due to motion is called (A) electrical energy, (B) kinetic energy (C) potential energy (D) motion energy.
2. Electrical current is measured in (A) volts (B) ohms (C) degrees Celsius (D) amperes.
3. Heat transfer through a solid is called: (A) conduction (B) convection (C) radiation (D) insulation.
4. Natural gas is mainly composed of (A) hydrogen gas (B) propane (C) butane (D) methane.
5. The effectiveness of an insulator is determined by: (A) its thickness (B) its strength (C) its conduction coefficient (D) its R-value.
6. The force moving a quantity of electricity is measured in: (A) ohms (B) volts (C) amperes (D) watts.
7. Energy due to the position of one body with respect to another or relative parts of the same body is called: (A) kinetic energy (B) potential energy (C) radiant energy (D) position energy.
8. Heat energy moved by currents is called: (A) conduction (B) convection (C) radiation (D) ampere.
9. Electrical energy is measured in: (A) kilowatt-hours (B) volts (C) amperes (D) calories.
10. Heat energy is measured in (A) kilowatt-hours (B) Btu (C) degrees Celsius (D) watts.
11. Heat transfer through space is called: (A) conduction (B) convection (C) radiation (D) insulation.

Instructor Information. . .

Answers to Glossary Fill-In (Energy Terms)

1. current
2. energy
3. insulation
4. R-value
5. calorie
6. kilowatt
7. amp
8. natural gas
9. celsius scale
10. infiltration

Answers to Identifying Energy Terms

1. B
2. D
3. A
4. D
5. D
6. B
7. B
8. B
9. A
10. B
11. C

Instructor Information. . .

Instructions to the Computer

Rationale:

By now, students have some specific ideas concerning energy conservation. This particular assignment asks students to creatively invent ways of instructing a computer to save energy. The purpose is to have students become aware of the importance of simple yet direct instructional writing.

Objective:

Students will be able to write instructions for the computer.

Implementation:

Explain to students that sometimes when they are giving little brothers and sisters instructions as to how to do something, that they have to be very simple and understanding in making the directions. (Give them some examples). Explain that for this activity they are going to be creative and develop some instructions to be given to a computer so it may be programmed to save energy. Hand out the "Instructions to the Computer" worksheet and read through the "set" (intrcduction) as well as the directions. Allow students time to think and then write for this activity.

Debriefing:

Have students volunteer to read their written instructions to the rest of the class. You may want to explain how programmers have to be very specific when working with computers and how computers can actually save energy in many ways.

Name _____

Date _____

Instructions to the Computer

Imagine that there is a computer in your house. This computer is connected to every electrical switch in the house, so that it can turn any light or appliance on or off. It is also connected to the furnace and air conditioner. It has a built-in clock that tells it what time, day of the week, date it is, and it has a gadget in each room that tells it whether there is anybody in the room. (But the computer can't tell the difference between a dog and a person). Without knowing this information, it may waste energy. It can tell the temperature outside and the temperature in each room inside.

Directions: You want to use this computer to save energy in your house. What instructions will you give it? (You can also add extra ways of getting information to the computer if you want). Remember, be specific.

To help you get started, here are half of two sample instructions. You can complete and use them.

1. If no human being is in the room, then _____

_____

2. If it is between 9 p.m. and 6 a.m. and there isn't anyone in any of the rooms except the bedrooms, then _____

_____.

What are some other instructions?

3. _____

_____

4. _____

_____

5. _____

_____

Instructor Information. . .

Appliance Labeling

Rationale: When you shop for a major appliance, look for the new yellow and black ENERGY GUIDE labels that will help you save money.

Objectives: Students will be able to read and interpret Energy Guide labels.

Students will be able to obtain the purchase price from retail price tags on certain appliances.

Implementation: Hand out "Appliance Labeling" reading. Read this information.

Debriefing: After students read and understand the differences in the Energy Guide labels, they can use the last page to do as an assignment. This is an outside-of-class assignment.

Name _____

Date _____

APPLIANCE LABELING

Facts You Should Know About Appliance Labeling

When you shop for a major appliance, look for the new yellow and black **Energy Guide** labels that will help you save money.

An **Energy Guide** label shows the yearly energy cost of operating an appliance and allows you to compare it to the energy cost of competing brands and models of a similar size with similar features. When considered along with the purchase price, you'll be able to determine which appliance is less expensive to own and operate over the long run.

Appliances Covered

Energy Guide labels are required on the following major appliances manufactured on or after May 19, 1980:

—Furnaces
—Refrigerators and refrigerator freezers
—Freezers
—Water heaters
—Clothes washers
—Dishwashers
—Room air conditioners

Central air conditioners and heat pumps will be labeled at a later date.

Energy Guide labels will not be used for kitchen ranges or ovens, microwave ovens, television sets, clothes dryers, humidifiers and dehumidifiers, or home heating equipment other than furnaces. These appliances have less difference in operating costs between brands and models.

Labels also will not be required on small appliances, such as toasters, blenders, and coffee makers because they require relatively little energy to operate.

The seven types of major appliances that are being labeled account for 73 percent of all energy consumed in American homes.

Name _____

Date _____

Federal Law

Appliance labeling was mandated by Congress as part of the Energy Policy and Conservation Act of 1975. The U.S. Department of Energy and Federal Trade Commission jointly manage its implementation.

(Name of Corporation)
Refrigerator-Freezer
Model(s) AH503, AH504, AH507
Capacity: 23 Cubic Feet
Type of Defrost: Full Automatic

ENERGYGUIDE

Estimates on the scale are based on a national average electric rate of 4.97¢ per kilowatt hour

Only models with 22.5 to 24.4 cubic feet are compared in the scale.

Model with lowest energy cost **$68**

$91

THIS MODEL

Model with highest energy cost **$132**

Estimated yearly energy cost

Your cost will vary depending on your local energy rate and how you use the product. This energy cost is based on U.S. Government standard tests

How much will this model cost you to run yearly?

		Yearly cost
		Estimated yearly $ cost shown below
Cost per kilowatt hour	**2¢**	$36
	4¢	$73
	6¢	$109
	8¢	$146
	10¢	$182
	12¢	$218

Ask your salesperson or local utility for the energy rate (cost per kilowatt hour) in your area.

Important Removal of this label before consumer purchase is a violation of federal law (42 U.S.C. 6302)

(Part No. 371026)

A Sample Energy Cost Label

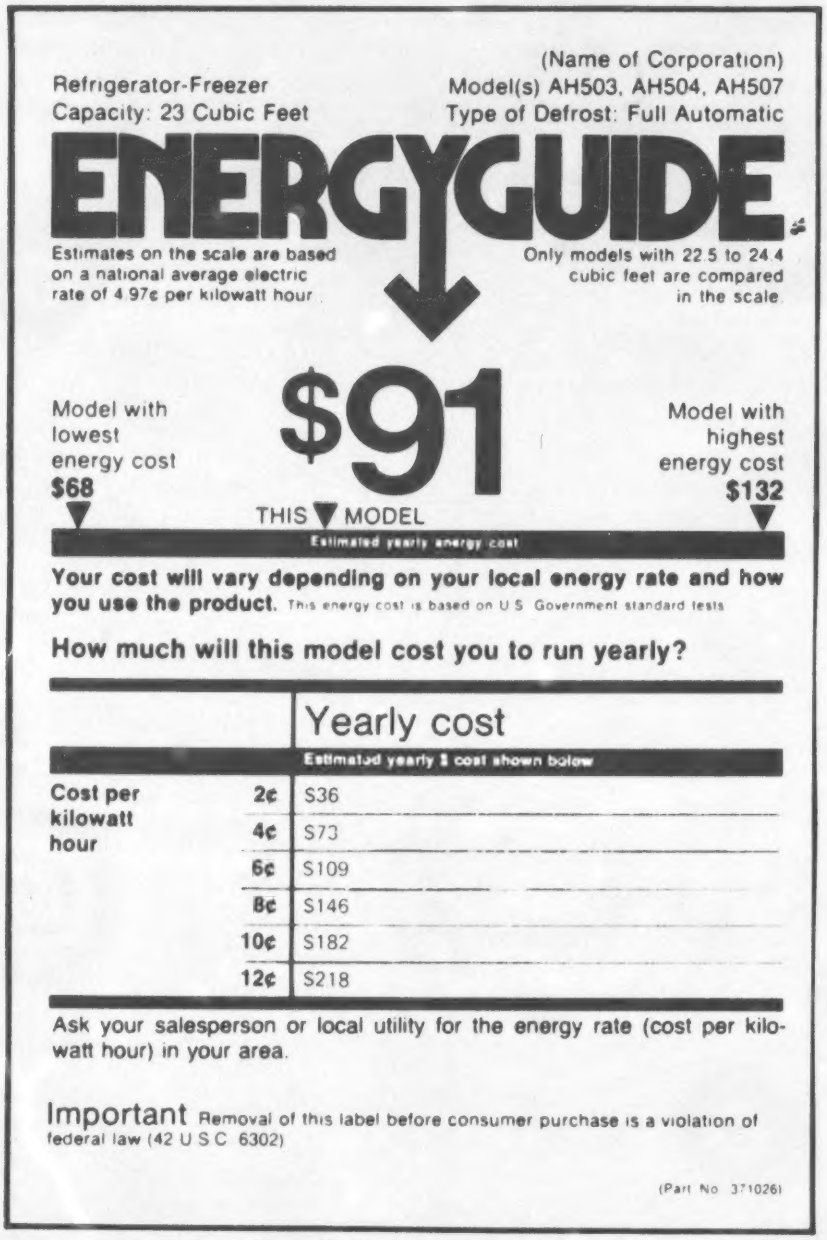
Energy-Efficient Appliances

You may find that energy-saving appliances cost slightly more to buy because intermittent ignition devices, better motors and compressors, more or better insulation, or other special features make manufacturing somewhat more expensive. Over the lifetime of an appliance, however, the lower operating cost of many energy-efficient products more than offsets the higher purchase price and helps to pay back the initial expenditure.

To shop for the best buy on major appliances, you need to become familiar with three types of **Energy Guide** labels: Energy Cost, Energy Efficiency Rating and Generic.

Name _____

Date _____



(Name of Corporation)
Refrigerator-Freezer
Model(s) AH503, AH504, AH507
Capacity: 23 Cubic Feet
Type of Defrost: Full Automatic

ENERGYGUIDE

Estimates on the scale are based on a national average electric rate of 4.97¢ per kilowatt hour.

Only models with 22.5 to 24.4 cubic feet are compared in the scale.

Model with lowest energy cost **$68**

$91

THIS ▼ MODEL

Model with highest energy cost **$132**

Estimated yearly energy cost

Your cost will vary depending on your local energy rate and how you use the product. This energy cost is based on U.S. Government standard tests.

How much will this model cost you to run yearly?

		Yearly cost
		Estimated yearly $ cost shown below
Cost per kilowatt hour	**2¢**	$36
	4¢	$73
	6¢	$109
	8¢	$146
	10¢	$182
	12¢	$218

Ask your salesperson or local utility for the energy rate (cost per kilowatt hour) in your area.

Important Removal of this label before consumer purchase is a violation of federal law (42 U.S.C. 6302)

(Part No. 371026)

A Sample Energy Cost Label

Energy Cost Labels

Energy cost labels are used on refrigerators and refrigerator freezers, freezers, water heaters, dishwashers, and clothes washers.

The large number in the center of the label is the estimated annual cost ($91) of the energy required to operate the appliance, based on a national average electricity rate of 4.97 cents per kilowatt-hour. The bar beneath it shows the range of operating costs of competing brands and models of similar size and features. Therefore, you will quickly be able to see how the model you are considering compares to others.

At the bottom of the label is a chart that allows you to determine more precisely what your cost to operate that appliance will be, based on your local utility rate.

Name _____

Date _____

Room Air Conditioner
Capacity: 9500 BTU/hr

(Name of Corporation)
Model(s) XXXXXXX

ENERGYGUIDE

Models with the most efficient energy rating number use less energy and cost less to operate.

Models with 9300 to 9799 BTU's cool about the same space.

Least efficient model
5.7

6.1

Most efficient model
10.2

THIS MODEL

Energy Efficiency Rating (EER)

This energy rating is based on U.S. Government standard tests.

How much will this model cost you to run yearly?

Yearly hours of use		250	750	1000	2000	3000
		Estimated yearly $ cost shown below				
Cost per kilowatt hour	2¢	$8	$23	$31	$62	$94
	4¢	$16	$47	$62	$125	$187
	6¢	$23	$70	$94	$187	$281
	8¢	$31	$94	$125	$250	$374
	10¢	$39	$117	$156	$312	$468
	12¢	$47	$140	$187	$374	$562

Ask your salesperson or local utility for the energy rate (cost per kilowatt hour) in your area. Your cost will vary depending on your local energy rate and how you use the product.

Important Removal of this label before consumer purchase is a violation of federal law (42 U.S.C. 6302)

GPO 883 391 (Part No. 20648)

A Sample Energy Efficiency Rating Label

Energy cost labels for dishwashers and clothes washers also include a chart that indicates the cost of running the appliance with either a gas water heater or an electric water heater. Your salesperson or utility company representative can tell you the energy rate for your area, or sometimes that information is included in your utility bill.

Energy Efficiency Rating Labels

Climate control appliances, such as room air conditioners, are labeled with an **Energy Efficiency Rating (EER)** or a **Seasonal Energy Efficiency Rating** (SEER). The rating is printed in large numbers in the center of the label. A **higher** number indicates a more efficient appliance.

Name _____

Date _____

(for central air conditioners
and furnaces)

ENERGYGUIDE

You can save substantially on home heating and cooling energy costs by following the simple steps outlined below:

1. Weatherproof your house
2. Assure energy efficient heating and cooling equipment selection and installation
3. Operate and maintain your system to conserve energy.

Help conserve energy. Compare the energy efficiency rating and cost information for this model with others. Check the figures and spend less on energy. Your contractor has the energy fact sheets. Ask for them.

Important

Removal of this label before consumer purchase is a violation of federal law (42 U S C 6302)

A Sample Generic Label

There also is a range—printed just below the energy efficiency rating—for competing room air conditioners of the same cooling capacity so that you can make shopping comparisons easily. In addition to the energy efficiency rating, the label provides a cost/use chart so that you can calculate the energy cost of the appliance based on local electricity rates and expected hours of use.

Generic Labels

The Generic label required on all furnaces contains general information on how to conserve energy in the home. It also directs you to an energy fact sheet developed by the manufacturers, which your dealer or heating system contractor will have for each product. The fact sheet contains information on system components and overall efficiency on different combinations, and gives energy costs of the system for various geographic locations and utility rates. Similar generic labels will be required for central air conditioning systems as soon as standards are final.

Name _____

Date _____

(for central air conditioners
and furnaces)

ENERGYGUIDE

You can save substantially on home heating and cooling energy costs by following the simple steps outlined below:

1. Weatherproof your house
2. Assure energy efficient heating and cooling equipment selection and installation
3. Operate and maintain your system to conserve energy.

Help conserve energy. Compare the energy efficiency rating and cost information for this model with others. Check the figures and spend less on energy. Your contractor has the energy fact sheets. Ask for them.

Important

Removal of this label before consumer purchase is a violation of federal law (42 U.S.C. 6302).

A Sample Generic Label

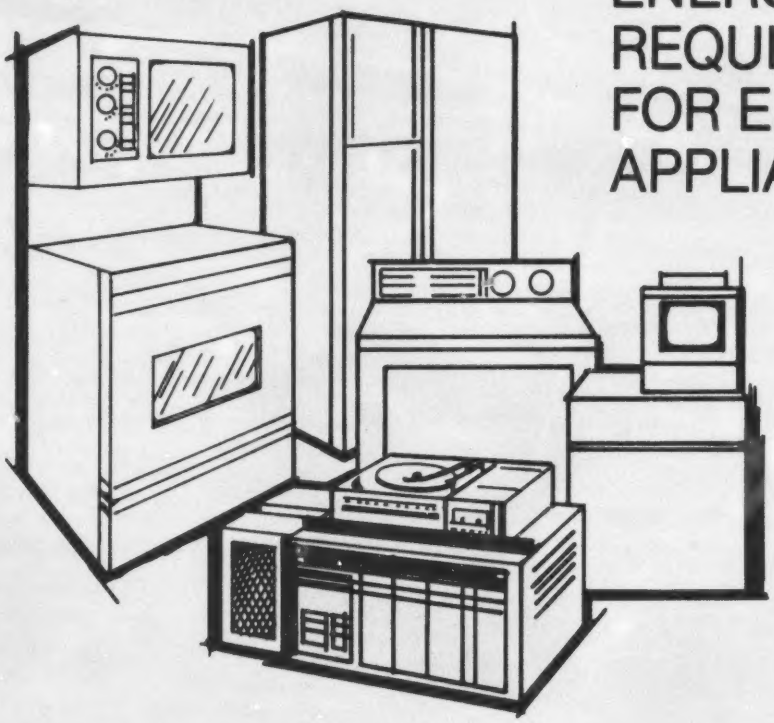
Use Appliances Wisely

In addition to buying the most energy-efficiency appliances suited to your particular needs, you can save even more money and natural resources by careful use of those appliances in your home. Consider combining loads in dishwashers and clothes washers, using low temperature settings where possible, avoiding unnecessary opening of refrigerator doors and other simple energy conservation methods. If we could cut residential energy use by only 20 percent, the reduction would amount to more than half a billion barrels of oil per year—or about one-sixth of our nation's imports.

Name _____

Date _____

Next time you shop for a major appliance, look for the new yellow-and-black Energy Guide labels that will tell you the appliance's energy cost and will allow you to compare it to the energy cost of similar models. The Energy Guide labels can help you save money because many energy-efficient products will cost less to operate over the long-run even though their initial purchase price may be somewhat higher.



ESTIMATED ENERGY REQUIREMENTS FOR ELECTRIC APPLIANCES

Name _____

Date _____

There is a simple way to figure which appliance is more economical. Let's compare two refrigerators, each having the same capacity and features, but with different purchase prices and operating costs:

	Model A	Model B
Purchase Price	$500	$400
Yearly Operating Cost	40	70

Use the following three steps to see how long it will take for the more expensive, energy-efficient model to pay for itself.

STEP 1 — Subtract the purchase price of the less expensive model from the price of the more expensive model. (In the above example, $500-$400 = **$100**).

STEP 2 — Subtract the lower yearly operating cost ($40) from the higher yearly operating cost ($70). (In the example, $70-$40 = $30).

STEP 3 — Divide the difference in the initial purchase price ($100) by the difference in yearly operating cost ($30). (In the example, $100 ÷ $30 = **3.33** years).

The answer to Step 3 is 3.33 years. It will take 3⅓ years for the lower operating cost of the more energy-efficient model to offset its higher initial purchase price. At $30 savings per year, you would save $450 in yearly operating costs over the expected 15 year lifetime of the refrigerator. Since the energy-efficient refrigerator costs only $100 more, you would actually save an estimated $350 over the refrigerator's lifetime.

Name _____

Date _____

Appliance Labeling

The average estimated life expectancy of water heaters, dishwashers and clothes washers is 11 years, room air conditioners 13 years, freezers 19 years, and furnaces 20 years. Savings achieved by selection of an energy-efficient appliance can be significant over the lifetime of the product—especially if fuel prices continue to rise as expected.

A worksheet is provided below for you to do your own shopping comparisons.

YOUR COMPARISONS

Obtain the purchase price from retail price tags on appliance models you are considering, and obtain yearly operating costs from Energy Guide labels. You may use the average operating cost shown in large numbers on the label. However, to be more accurate, you should use your local energy rates. You can use the table on the label to convert your local energy rate to estimate your annual operating cost. Contact your local utility or check your bills to find your local rate.

	Model Name: _____	Model Name: _____
Purchase Price	$_____	$_____
Yearly Operating Cost	$_____	$_____

STEP 1. Subtract less expensive price from more expensive price.

$ _____ ÷ $ _____ = $ _____

STEP 2. Subtract lower operating cost from higher operating cost.

$ _____ ÷ $ _____ = $ _____

STEP 3. Divide difference in price by difference in operating cost. (Answer to Step 1 divided by answer to Step 2).

$ _____ ÷ $ _____ = $ _____

Instructor Information. . .

Don't Be a Big Drip—Save Little Ones

Rationale:

Students will see a relationship exists between awareness of energy sources and the conservation of energy. They will see how something small can waste lots of energy.

Objective:

Students will be able to increase their awareness of energy waste by computing liquid volume using multiplication and division skills.

Materials:

One 8-ounce glass or plastic measuring cup, pencil and paper, leaky faucet, clock.

Procedure:

1. Place measuring cup under a dripping hot water faucet and collect 15 minutes of drips.
2. Compute how much energy was wasted.
   a. Multiply number of ounces of water by 4.
   Example: 4 oz. x 4 = 16 oz. per hour
   b. Multiply answer in (a) by 24
   Example: 16 oz. x 24 = 384 oz. per day
   c. Multiply answer in (b) by 365
   Example: 384 oz. per day x 365 = 140,160 oz. per yr.
   d. Divide answer in (c) by 128
   Example: 140,160 oz. per year ÷ 128 = 1,095 gallons per year.
   e. For oil fired hot water heater divide answer (d) by 110, which gives the approximate number of gallons of oil wasted.
   Example: 1,095 ÷ 110 = 9.95 gallons of oil per year.
   f. For gas fired hot water heater divide answer (d) by 0.84, which gives the approximate number of cubic feet of gas wasted.
   Example: 1,095 ÷ 0.84 = 1,304 cubic feet of gas per year.
   g. For electric hot water heater, multiply answer (d) by 0.25, which gives the approximate number of kilowatt hours of electricity wasted.
   Example: 1,095 x 0.25 = 274 kilowatt hours.

Debriefing:

This experiment can usually be done in the school. It may be much more useful to have students do the experiment in school first, then transfer this learning to their homes. Therefore, it would make a fine homework assignment which could be discussed in class the following day.

Instructor Information. . .

Insulation Investigation

Rationale:

Insulating the home is one of the best ways to save energy. 70 percent of our residential energy is used to heat and cool our homes. We can cut our energy use and help control living costs by making our homes energy efficient, even if we have to spend some money to do this.

Objectives:

Students will be able to read two stories concerning insulation.

Students will be able to identify insulation R-values used in Nebraska residential construction. Students will be able to identify differences in caulking and weatherstripping materials.

Implementation:

Hand out "Know How To Save Energy and Money" reading. Have students read and discuss. Then hand out "Protect Your Home From Outside Heat and Cold" reading. Read and discuss. Hand out "Insulation Investigation worksheet and explain the top portion to students. Based on this explanation, have students answer questions on the lower half of the page. The next page is an informational page which is an excellent handout for students to take home and share with their families. It is followed by a "Student Worksheet" which can be answered using the information sheet.

Debriefing:

Through the two readings, attempt to have students gain an understanding of the importance insulation makes in the savings of energy. The worksheets focus students' attention on insulating, caulking, and weatherstripping. You may choose to read and discuss the information sheet on caulking and weatherstripping before sending this home with the students.

Name _____

Date _____

"Know How To Save Energy And Money"

Most homes, built in the days when energy was plentiful and cheap, don't have enough insulation—but insulation **can** be added to any house, even if some already exists. Insulating an attic floor, where savings generally will be greatest, usually can be done by the homeowner.

Other home improvements that will save energy are to insulate sidewalls, add storm windows and doors, install weatherstripping, and caulk around windows and door frames. Even as simple an "improvement" as setting the thermostat no higher than 65 degrees in winter and no lower than 78 degrees in summer will save a surprising amount of energy.

In the heating season alone, adequate insulation in the attic floor generally will save up to 20 percent on fuel bills.

In your case, the percentage of savings will depend upon how much insulation you had before you added more, the attic area of your house in relation to wall area, number and size of windows and doors, and whether you have storm windows, doors and good weatherstripping.

The exact amount of money you will save is affected, of course, by the rates you pay for fuel and electricity. However, no matter what those rates are, if you make energy-conserving improvements to your home now, you can expect even greater future dollar savings as energy costs rise with inflation.

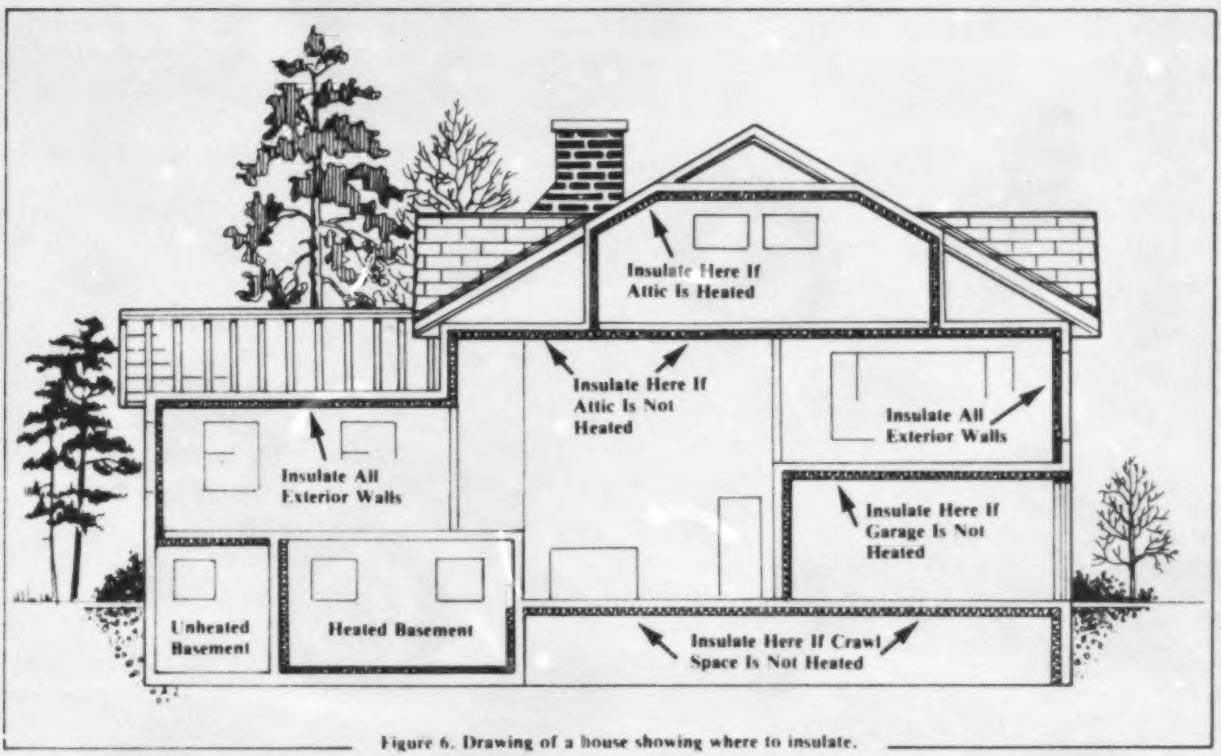

Insulate Here If Attic Is Heated
Insulate Here If Attic Is Not Heated
Insulate All Exterior Walls
Insulate All Exterior Walls
Insulate Here If Garage Is Not Heated
Unheated Basement
Heated Basement
Insulate Here If Crawl Space Is Not Heated

Figure 6. Drawing of a house showing where to insulate.

Name _____

Date _____

Protect Your Home From Outside Heat and Cold

About 40 million single-family homes in the United States are not adequately protected from outside weather, according to Department of Energy estimates.

Here are some tips to make sure yours is not one of them.

Insulate

No matter how you heat or cool your home, you can reduce the load on your heating and cooling equipment by as much as 20 to 30 percent by investing a few hundred dollars in insulation. That's about as much as it would cost you to buy a color television set. But the benefits of insulation—lower utility costs—continue for years.

Find Out If Your Home Needs Insulation

Your needs will depend on the climate in which you live and the amount of insulation, if any, you already have. For guidance, consult with a reputable insulation dealer in your community or with your local building inspector or county agent.

BEFORE YOU BUY YOUR INSULATION MATERIALS

Find out about R-Values. Then buy the thickness of insulation that will give you the R-value you should have.

R-values or numbers are insulation efficiency ratings. The "R" stands for resistance to winter heat loss or summer heat gain. The higher the R-number, the more effective the insulating capability. The numbers should appear on packages of all insulation materials: mineral, glass, fiber, or rock wool batts or blankets; foam or loose fill materials that are poured or blown into insulation spaces; or rigid board insulation.

If the insulation you buy doesn't have the R-value written on the package, ask the salesperson to write the R-value on your receipt for future references.

Sources for R-value information include: Department of Energy [Nebraska Energy Office] National Bureau of Standards, U.S. Department of Commerce; American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE); and insulation manufacturers.

Name _____

Date _____

Insulate Or Increase the Amount Of Insulation

In Your Attic Floor Or Top Floor Ceiling
(to a minimum of R-26 for these spaces.)

If you have old insulation in your attic, you probably won't be able to judge its R-value. But if you have less than 6 inches of old insulation, chances are you need more to bring the insulation level up to the recommended level. Investment costs could range from $80 to $600. Heating and cooling savings should range from somewhere around 5 percent, if you are adding to present insulation, to as much as 30 percent if you have no insulation.

Don't Insulate Over Eave Vents

(or on top of recessed lighting fixtures or other
heat-producing equipment on the attic floor)

Also, keep insulation at least 3 inches away from the sides of these types of fixtures.

Consider Insulating Exterior Walls

This is an expensive measure that requires the services of a contractor, but it may be worth the cost if you live in a very hot or very cold climate. There should be enough space in the walls to accommodate blown-in insulation that is at least R-11 to R-13 in most construction except masonry. Savings could amount to 16 to 20 percent of utility bills.

Insulate Floors and Unheated Spaces
(such as crawl spaces and garages.)

Costs could range from $200 to $400. Savings could amount to about 8 percent on your heating and cooling bills.

Name _____

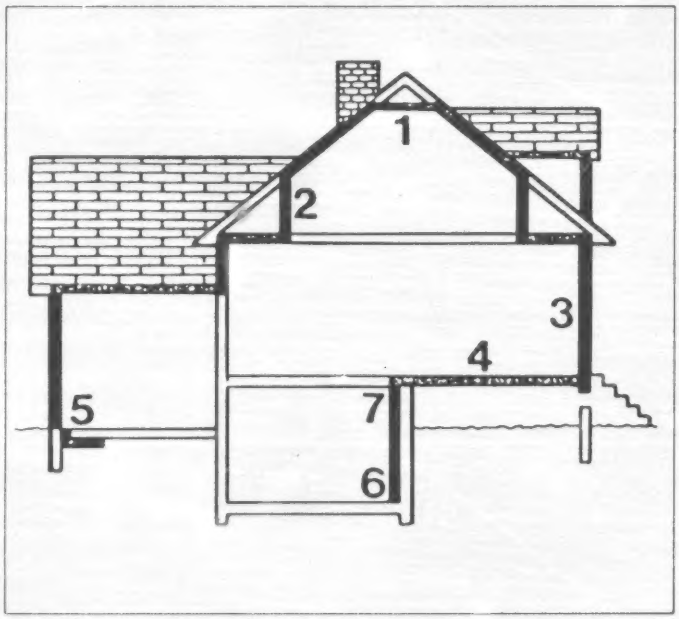
Date _____

INSULATION INVESTIGATION

The best time to install insulation is during construction. Adding insulation to an existing structure requires more effort, but the time to start is now! Delay means continually higher costs for heating and cooling. The illustration below shows where a home should be insulated.

Where to insulate a home

1. Ceilings with cold spaces above
2. Rafters and "knee" walls of a finished attic
3. Exterior walls or walls between heated and unheated spaces
4. Floors over unheated or outside spaces
5. Perimeter of a concrete floor slab close to grade level
6. Walls of finished or heated basement
7. Top of foundation or basement wall



Buy insulation by the "R-Value", not by the thickness. The higher the total "R-Value" the more effective the insulation Recommended residential construction "R-Values" for Nebraska are:

LOCATION	R-VALUE RANGE
Ceilings	25-38
Walls	16-22
Floors	20-25

Directions: Examine this illustration, then answer these questions.

1. What is the recommended R-value range you should use in Nebraska for:

Ceilings _____ - _____

Walls _____ - _____

Floors _____ - _____

55

Name _____

Date _____

2. When is the best time to install insulation?

_____

3. Which insulation is more effective, R-15 or R-38? _____

4. Besides for heating purposes, what good does insulating do?

_____

5. Would you insulate the floor over a cold space?

Yes _____ No _____

WEATHERIZE NOW—YOU CAN DO IT!

Name _____

Date _____

Information Sheet

Caulking and Weatherstripping

Check all outside areas where two different materials or parts of the house meet. Caulk wherever a permanent seal is desired and weatherstrip where surfaces must be moved, but a snug seal is needed.

Caulking materials that adhere to wood, glass, metal, plastic and masonry should be selected since these materials expand and contract. Resistance to weathering, cracking, shrinkage, water and mildew are also important.

More durable types of weatherstripping are the best investment since they are more effective and will last longer. Effectiveness against drafts, durability, aesthetics and ease of installation are all factors to consider when making your choice.

Where to Apply Caulking

1. Around windows and doors where the frame meets the siding.
2. Around exterior plumbing fixtures, electric outlets, exhaust vents and air conditioners which penetrate the siding.
3. Along skylights, vents and chimney flashings where they penetrate the roof and siding.
4. At sill joists and between dissimilar materials such as wood and masonry.
5. At corners where two pieces of siding meet.

Where to Apply Weatherstripping

6. Around loose fitting windows.
7. Inside the frames of entrance doors.
8. On the bottom of doors or on the threshold.
9. At the bottom of garage doors.
10. Around doors or any other openings between heated and unheated areas (example: attic openings, doors between living space and garage or another unheated room).

CAULKING MATERIALS

TYPE	COST	DURABILITY	COMMENTS
SILICONE	high	20 years	seals most dissimilar building materials; cannot be painted
BUTYL RUBBER	high	7-10 years	seals most dissimilar materials; can be painted
ACRYLIC LATEX	moderate	5-7 years	seals joints, fills cracks and nailholes
OIL-BASE	low	1-2 years	seals holes and cracks in exterior building materials not subject to stress

WEATHERSTRIPPING MATERIALS

TYPE	COST	DURABILITY	COMMENTS
FOAM or FELT STRIPS	low	poor	good for irregular gaps in low friction areas
TUBULAR GASKET	moderate	moderate	good against sliding surfaces; poor for irregular gaps
SPRING METAL	moderate	good	use between sliding surfaces; poor for irregular gaps
INTERLOCKING STRIPS	high	good	best seal; must be installed professionally
DOOR SHOES & THRESHOLDS	high	moderate	suitable for slightly uneven gaps; vinyl gaskets are replaceable
DOOR SWEEPS	moderate	moderate	suitable for slightly uneven gaps; adjustable
GARAGE DOOR STRIP	moderate	moderate	suitable for uneven gaps

Name _____

Date _____

Directions: Using the **Information Sheet** on caulking and weatherstripping, answer questions which pertain to each section.

Caulking and Weatherstripping

1. You should caulk wherever a _____ seal is desired and _____ where the surfaces must be moved.

2. Effectiveness against drafts, durability, aesthetics and ease of _____ are all factors to consider when making your choice.

Where to Apply Caulking

3. Apply caulk at sill joists and between dissimilar materials such as _____ and _____.

4. Apply caulk at corners where two pieces of _____ meet.

Where to Apply Weatherstripping

5. You should apply weatherstripping at the bottom of _____.

6. You should apply weatherstripping around doors or any other openings between _____ and _____ areas.

Caulking Materials

7. What is the estimated durability of silicone caulk?

_____

8. What type of caulk seals joints, fills cracks and nailholes?

_____

Weatherstripping Materials

9. What type of weatherstripping provides the **best** seal and must be installed professionally?

_____

10. What kind of durability does garage door strip have?

_____

Instructor Information. . .

Answers to Insulation Investigation

1. Ceilings — 25-38
   Walls — 16-22
   Floors — 20-25
2. The best time to install insulation is during construction.
3. R-38
4. Insulation not only keeps a building warm in the winter, it also keeps a building cool in the summer.
5. Yes

Answers to Information Sheet on Caulking and Weatherstripping

1. permanent, weatherstrip
2. installation
3. wood, masonry
4. siding
5. garage doors
6. heated, unheated
7. 20 years
8. acrylic latex
9. interlocking strips
10. moderate

Instructor Information. . .

Conservation Calendar

Rationale:

Students have been given several methods to save energy in their homes: how to read electric meters, how to read gas meters, how to read energy guide labels, types of weatherstripping and caulking to use and other ways to save. Now it is time they attempt to look for little (or big) ways to save energy.

Objectives:

Students will be able to write down ways they can save energy in their homes.

Students will be able to compare and discuss their calendars.

Implementation:

Handout "Conservation Calendar" to students. Suggest ways students can save energy in their homes. Have students write down things they can do for each day in order to save energy. Students may need to take their calendars home to complete them.

Debriefing:

Have students suggest ways they can save energy and have them give examples. If this is given as an assignment, when students complete these calendars, discuss possible ways they found to save energy.

Energy Conservation in the Home
Activity #10
Worksheet, Page 1

Name _____

Date _____

Directions: By now you know **some** ways you can save energy in your home. Even doing something as simple as pulling a shade down at night time can save energy. Your task is to write down some things each day you can do to save energy. How many ways can you find to save energy?

Conservation Calendar

Monday _____

Tuesday _____

Wednesday _____

Thursday _____

Friday _____

Saturday _____

Sunday _____

Instructor Information. . .

Poster Displays

Rationale:

Poster displays allow students self-expression and generate enthusiasm for all ages. Secondary level art and technical drafting students could also be involved in more sophisticated poster displays.

Objectives:

Students will be able to design, develop, and display a poster concerning one of the following energy themes:
1) "The energy wasters"
2) "The best way to conserve energy at home"
3) "How I save energy"
4) "Conservation is . . ."

Implementation:

It would be worthwhile for the teacher to spend some time discussing energy usage and energy conservation techniques before the announcement of this project. This would provide many ideas for students to draw upon when developing their posters. Review the references for general literature on energy conservation that would be applicable for class discussions.

Debriefing:

Display posters throughout the room, school building.

SUPPLEMENTAL MATERIALS GUIDE

Appliance Labeling, U.S. Department of Energy.

Budgeting Electricity, Lincoln Electric System, Lincoln, Nebraska 68508.

Energy 80, John Lord, Editor-in-Chief, Enterprise for Education, Inc. February, 1981.

***Energy Info—A Directory of Publications and Audio Visual Materials From the Nebraska Energy Office.**

The Home Energy-Saving Book, Shell Oil Company, P.O. Box 61609, Houston, Texas 77208.

Something Special For Teachers, Northern Colorado Board of Cooperative Services, Longmont, Colorado, January, 1981.

Nebraska Energy Savings Manual, Morrison, James W. (New York: Harper and Row), 1979.

*This publication contains a list of films available on this topic.

Energy Information Request Form

Help Conserve the Good Life of Nebraska

Mail to: Nebraska Energy Office
P.O. Box 95085
Lincoln, NE 68509

NAME _____

ADDRESS _____

_____ Phone _____

Please forward publications on the following topics:

_____

_____

_____

_____

_____

_____

_____

_____

Please schedule the following audiovisual(s);

Title	Requested Date	Alternative Date
_____	_____	_____

_____ Place my name on the mailing list for the free bimonthly energy newsletter, **Nebraska Energy News**.

Energy Conservation in the Home